

REMARKS

This application has been carefully reviewed in light of the Office Action dated July 20, 2004. Claim 13 has been amended. Claims 44 and 45 have been added. Claims 13-45 are now pending. Applicants reserve the right to pursue the original claims and other claims in this and other applications. Applicants respectfully request reconsideration of the above-referenced application in light of the amendments and following remarks.

At the outset, Applicants note that the present application is a divisional of U.S. Patent Application No.: 09/252,448, filed on February 18, 1999, which issued as U.S. Patent No.: 6,713,234 on March 30, 2004. Applicants further note that some prior art rejections of pending claims 18, 20-32, and 34-43 are predicated on the Lin, et al. (U.S. Patent No. 6,210,856 B1) ("Lin") reference.

The earliest effective date of the Lin reference is January 27, 1999. However, the subject matter of claims 18, 20-32, and 34-43 was conceived prior to the earliest reference date (i.e., January 27, 1999, the date of the Lin reference) and was diligently pursued from prior to that date toward a constructive reduction to practice, which occurred on the February 18, 1999 filing date of the parent application, from which the present application is a divisional of.

A Rule 131 Declaration from one of the inventors, Zhiping Yin, attesting to this is attached. The Declaration establishes a "prior invention" with respect to the earliest effective date of the references, the date of the Lin reference (i.e., January 27, 1999). That is, the Declaration establishes conception of the claimed invention prior to the effective date of the Lin reference (i.e., January 27, 1999), coupled with due diligence from prior to the reference date to the filing date of the parent application (i.e., February 18, 1999), from which the present application is a divisional of. See M.P.E.P.

§715.07. "A rejection based on 35 U.S.C. 102(e) can be overcome by . . . [f]iling an affidavit or declaration under 37 C.F.R. §1.131 showing prior invention." M.P.E.P §706.02(b). Accordingly, Lin is not a proper reference and all rejections based thereon should be withdrawn.

Claims 13-17 and 19 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai in view of Fiordalice and Miller. The rejection is respectfully traversed.

The claimed invention relates to a semiconductor device using anti-reflective coatings. As such, independent claim 13 recites by *inter alia*, a semiconductor device comprising: "a layer that is transparent to light having a first thickness; and a first continuous anti-reflective coating formed beneath the transparent layer having a second thickness, wherein said first thickness is greater than the second thickness."

Tsai relates to a "a chlorine containing plasma etched patterned layer." (Abstract). Tsai teaches that a silicon oxide dielectric layer 13 is formed over a blanket target layer 12. (Col. 5, lines 21-24; Figure 1). Tsai also teaches that a "blanket hard mask layer 14" is formed over the silicon oxide dielectric layer 13." (Col. 5, lines 23-24). According to Tsai, "the blanket hard mask layer 14 is formed from a material selected from the group consisting of silsesquioxane spin-on-glass (SOG) materials and amorphous carbon materials." (Col. 6, lines 45-49).

Fiordalice relates to "conductive plugs in a semiconductor device without the use of common titanium and titanium nitride glue layers which line the plug opening." (Col. 2, lines 66-67; Col. 3, lines 1-2). Fiordalice teaches "a conductive plug (46) is formed in a semiconductor device (30) by using an aluminum nitride glue layer (42)." (Abstract). In Fiordalice, the "glue layer is deposited on an interlayer dielectric (40)

prior to forming a contact opening (44), such that the glue layer does not line the opening sidewalls or bottom.” (Abstract). Fiordalice also teaches that “[t]ungsten or other plug material is then deposited in the opening and on the glue layer and subsequently polished or etched back to form the plug.” (Abstract).

Miller relates to “doped semiconductor vias to contacts.” (Abstract; Title). Miller teaches that “an undoped wide band-gap semiconductor (18) is used for the insulating layer to isolate the silicon substrate from the metal interconnection pattern.” (Abstract). This way, conductive vias are provided “through the insulating layer for connection to the source and drain of the transistors of the circuit.” (Abstract). Miller teaches that the wide band-gap semiconductor 18 is formed of carbon and that, “[S]ince low resistance connection needs to be made to source and drain regions,” carbon layer 18 “needs either to be opened up or to be converted to a good conductor.” (Col. 1, lines 63-67; Figure 1). Miller also teaches that the undoped wide band-gap semiconductor is selectively implanted with a dopant, which is preferably nitrogen, “in the portion overlying the source and drain.” (Abstract).

The subject matter of claims 13-17 and 19 would not have been obvious over Tsai in view of Fiordalice and Miller. Indeed, the Office Action fails to establish a *prima facie* case of obviousness. To establish a *prima facie* case of obviousness, three requirements must be met: (1) some suggestion or motivation, either in the references themselves or in the knowledge of a person of ordinary skill in the art, to modify the reference or combine reference teachings; (2) a reasonable expectation of success; and (3) the prior art reference (or references when combined) must teach or suggest all the claim limitations. More importantly, the teaching or suggestion to make the claimed combination and the reasonable expectation for success must both be found in the prior art and not based on the Applicants’ disclosure. See, e.g., In re Royka, 490 F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974).

In the present case, not all limitations of claim 13 are taught or suggested by the prior art references, whether considered alone or in combination. None of Tsai, Fiordalice and Miller teaches or suggests "a layer that is transparent to light having a first thickness; and a first continuous anti-reflective coating formed beneath the transparent layer having a second thickness, wherein said first thickness is greater than the second thickness," as independent claim 13 recites.

Tsai, in contrast, teaches that the blanket hard mask layer 14, which would arguably correspond to the transparent layer of the claimed invention, "is formed from a material selected from the group consisting of silsesquioxane spin-on-glass (SOG) materials and amorphous carbon materials" (col. 6, lines 45-49), and not of "a material selected from the group consisting of BPSG, PSG and TEOS," as dependent claim 15 recites. Further, Tsai simply does not teach or suggest, "a layer that is transparent to light having a first thickness; and a first continuous anti-reflective coating formed beneath the transparent layer having a second thickness, wherein said first thickness is greater than the second thickness," as recited in claim 13 (emphasis added).

Fiordalice teaches a semiconductor substrate 32 having an overlying dielectric layer 34 and a metal interconnect 36," (col. 3, lines 41-42; figure 3) but notes that "dielectric layer 34 is not even required in that a conductive plug in accordance with the present invention can be made to electrically contact a doped or conductive portion of substrate 32 instead of to a metal interconnect." (Col. 4, lines 20-24). Fiordalice also teaches that "an interlayer dielectric 40 overlies interconnect 36." (Col. 4, line 26; Figure 3). However, Fiordalice fails to disclose "a first continuous anti-reflective coating formed beneath the transparent layer," as independent claim 13 recites.

Miller also fails to teach or suggest any of the limitations of independent claim 13. Miller does not even mention “an anti-reflective coating” or “a layer which is transparent to the wavelength of light,” much less the device as recited in independent claim 13. As noted above, Miller teaches selective boron implantation of a wide band-gap semiconductor, which is preferably formed of carbon and which “needs either to be opened up or to be converted to a good conductor” (col. 1, lines 63-67; Figure 1).

Additionally, a person of ordinary skill in the art would not have been motivated to combine Tsai with Fiordalice and Miller to arrive at the claimed invention. The crux of Tsai is etching a blanket target layer used in microelectronics fabrication to form a chlorine containing plasma etched layer. (Abstract; Title). In contrast, Fiordalice relates to a “method of forming a conductive plug in a semiconductor devices” (col. 1, lines 20-22) and not to a method of etching a blanket layer as in Tsai. Furthermore, Miller relates to selective implantation with boron of a carbon layer which “needs either to be opened up or to be converted to a good conductor” (col. 1, lines 63-67; Figure 1), and not to a method of etching of a blanket target layer as in Tsai. For at least these reasons, a person of ordinary skill in the art would not have been motivated to combine Miller and Fiordalice with Tsai to arrive at the subject matter of claims 13-17 and 19. Accordingly, withdrawal of the rejection of claims 13-17 and 19 is respectfully requested.

Claims 21-24, 26, 28-31, and 36 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai in view of Fiordalice and Miller, and further in view of Lin. The rejection is respectfully traversed.

For at least the reasons provided above, Tsai, Fiordalice, and Miller do not teach or suggest “a layer that is transparent to light having a wavelength of approximately 365 nm; and a first anti-reflective coating extending substantially entirely beneath the transparent layer,” as recited in claim 21. Further, there is no motivation to combine Tsai, Fiordalice, and Miller. The references are directed to solving different problems. Lin is relied upon for disclosing mid-UV of 365 nm and extreme UV of 193 nm, and adds nothing to rectify the deficiencies of Tsai, Fiordalice, and Miller.

Moreover, as noted above, Lin is not a proper reference. Accordingly, claims 21-24, 26, 28-31, and 36 are believed to be in condition for allowance over the prior art of record: Tsai, Fiordalice, and Miller.

Claims 18, 20, 25, 27, 32, 34-45, and 37-43 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai in view of Fiordalice, Miller and Lin, and further in view of Jain. The rejection is respectfully traversed.

For at least the reasons provided above, Tsai, Fiordalice, Miller, and Lin do not teach or suggest “a layer that is transparent to light having a wavelength of approximately 365 nm; and a first anti-reflective coating extending substantially entirely beneath the transparent layer,” as recited in claim 21. Further, there is no motivation to combine Tsai, Fiordalice, and Miller. The references are directed to solving different problems.

Further, Lin is not a proper reference for the reasons noted above. Accordingly, claims 18, 20, 25, 27, 32, 34-45, and 37-43 are believed to be in condition for allowance over the prior art of record: Tsai, Fiordalice, Miller, Lin, and Jain.

Application No.: 10/684,431

Docket No.: M4065.0316/P316-A

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Dated: October 20, 2004

Respectfully submitted,

By 

Thomas J. D'Amico

Registration No.: 28,371

DICKSTEIN SHAPIRO MORIN &

OSHINSKY LLP

2101 L Street NW

Washington, DC 20037-1526

(202) 785-9700

Attorney for Applicants